106. Work on Problem 1 of Section 9.2 in the textbook.

107. Work on Problem 3 of Section 9.2 in the textbook.

108. Let $M_1, M_2 \subset \mathbb{R}^n$ be nonempty and $x_0 \in \mathbb{R}^n$. Show:
   
   (a) If $M$ is closed, then there exists $a \in M$ with $d(x_0, M) = \|x_0 - a\|$. 
   
   (b) If $M_1$ is compact and $M_2$ is closed, then there exists $a \in M_1$ and $b \in M_2$
       such that $d(M_1, M_2) = \|a - b\|$. 

109. Find all points where $f$ defined by
   \[ f(x, y, z) = \left( \log \frac{\sqrt{|x| + x^2 y^4 + 1}}{\sqrt{1 - x^2 - y^2}} \right) \]
   is continuous.

110. Consider the function $f : \mathbb{R}^2 \to \mathbb{R}$ given by
   \[ f(x, y) = \begin{cases} 
   \frac{xy}{x^2 + y^2} & \text{if } (x, y) \neq (0, 0), \\
   0 & \text{if } (x, y) = (0, 0). 
   \end{cases} \]
   Show:
   
   (a) $f$ is continuous on $\mathbb{R}^2 \setminus \{(0,0)\}$;
   
   (b) $f$ is not continuous in $(0,0)$;
   
   (c) the functions $f_1(x) = f(x, y)$ (where $y \in \mathbb{R}$ is fixed) and $f_2(y) = f(x, y)$
       (where $x \in \mathbb{R}$ is fixed) are both continuous on $\mathbb{R}$.

111. Suppose $f : M \to \mathbb{R}^m$ and $M \subset \mathbb{R}^n$ is closed. Show that $f \in C(M)$ iff the
   inverse images of closed sets are closed.

112. Show that $F(x) := \int_{-\infty}^{\infty} \cos(xt)e^{-\frac{t^2}{2}}dt$ exists and is continuous on $\mathbb{R}$.

113. Show that $M \subset \mathbb{R}$ is connected iff $M$ is an interval.